

AMENDMENTS TO THE DRAWINGS

Please find attached two (2) replacement drawing sheets for replacing FIGS. 1 and 2 of the drawings.

Attachment: Two (2) Replacement Sheets.

REMARKS

Claims 1-5, 7-10, 12-16, 18-24, and 26 are all the claims pending in the application. By this Amendment, Applicant amends the claims to better conform them to U.S. patent practice. Claims 6, 11, 17, 25, and 27 have been cancelled without prejudice or disclaimer.

Substitute Specification

Applicant has amended the Specification of the instant application. Applicant requests that the Specification be deleted in its entirety, and be replaced with the Substitute Specification attached hereto. The Substitute Specification complies with 37 C.F.R. § 1.52(a)-(b) and 37 C.F.R. § 1.125(b) and no new matter has been added to the Substitute Specification. Applicant is also providing a red-line version of the Substitute Specification, in compliance with 37 C.F.R. § 1.121(b)(3) and 1.125(b) and (c). Entry of the Substitute Specification is respectfully requested.

Drawings Objection

The drawings are objected to by the Examiner due to various informalities. In view of the replacement sheets being submitted herewith to replace FIGS. 1 and 2, Applicants respectfully submit that the informalities noted by the Examiner have been corrected.

In particular, the Examiner requires that the designation of FIG. 1 to be shown as Prior Art. The Applicant has accordingly amended FIG. 1 by incorporating the legend "Prior Art" in FIG. 1. Applicant believes that the amended FIG. 1 complies with the requirement as under MPEP § 608.02(g).

The Office Action also objects to the drawings as failing to comply with 37 CFR 1.84 (p) (5) because they include the following reference characters not mentioned in the description - 5, 8, 15 and 26 in Figure 2; 26a and 26b in Figure 3; and 34 and 35 in Figure 4.

In response, Applicant notes that reference characters 15 and 26 are deleted from Fig.2. A suitable description is provided for reference characters 5, 8, 26a, 26b, 34, and 35 of FIGS. 2 and 3, as shown in the aforementioned Substitute Specification.

Applicant believes that the drawing sheets are in compliance with 37 CFR 1.121(d). Accordingly, withdrawal of the drawings objection is respectfully requested.

In response to the objection relating to non-depiction of the “hydraulic power means consisting of a hydraulic pack and the hydraulic cylinders with suitable sealing mechanism”, Applicant respectfully submits by drawing the attention to Figs 1 & 3 of the accompanied drawings, the hydraulic power means as used in the system of the claimed invention, is a general hydraulic power pack mechanism, that includes a driving member, which is generally a motor and driven members such as movable hydraulic cylinders. A reservoir filled with hydraulic liquid along with a pump is connected to the motor and the movable hydraulic cylinders. A reciprocal motion is imparted to the hydraulic cylinders, which is caused by their displacement while driven by the motor. The hydraulic pack is also vided with a sealing mechanism to prevent the leakage of hydraulic liquid during the course of working of the hydraulic cylinders.

Accordingly, in a non-limiting embodiment of the claimed invention, the hydraulic power means with hydraulic pack includes hydraulic cylinders (26a and 26b) connected to a motor (4) in order to provide a drive for imparting reciprocal displacement of the movable hydraulic ramming members (11a) and pistons (11). The hydraulic power pack also includes a reservoir and a pump (not shown in the figures) connected to the movable hydraulic ramming members (11a) and motor (4). The movable ramming members (11a) are connected to the hydraulic cylinders (26a & 26b), to impart to and fro motion for the ramming members (11a) by the reciprocal displacement of the cylinders. The hydraulic liquid as present in the reservoir is used

to lubricate the moving parts of the hydraulic mechanism. The hydraulic cylinders (26b) are also provided with suitable sealing mechanism to prevent leakage during the reciprocating motion of the pistons (11). Therefore, in the claimed invention the hydraulic pack is used as adopted by the Applicant, is a general hydraulic system to exert a reciprocal drive to the ramming members (11a). The Applicant has adopted a basic and general hydraulic mechanism to cause reciprocal movement to the hydraulic cylinders and to rotate the containers (7) and hence features including reservoir, sump and pump, which are integral to a hydraulic mechanism, are not explicitly shown in the Figures.

The Office Action also objects to the absence of structural details of “a hydrogen gas inlet (31) with ‘T’ connection (36a, 36b, 36c) originating from various outlets (1) of the cylinders of the system” as shown in Fig 1 as described in the specification under 37 cfr 1.83 (a).

In response, Applicant, by referring to Figs 2 and 4, submits that Fig 4 discloses a control panel (29) with time and change over switches (30 & 31) to control the selection of cylinders (7a) as desired. The outlets (1) (Fig 1) originating from various cylinders (7a) are connected to “T” connection (36b and 36c) and connected to a pipe with valve (32) through connection (36a). The hydrogen flow rate is controlled by hydrogen pressure regulator (33). The regulated hydrogen gas is sent out by means of valve (32) for further use.

Applicant also has also undertaken the appropriate corrections to the relevant portions of the written description, as shown in the Substitute Specification.

In view of the above, Applicant respectfully requests the Examiner to waive the objections as asserted under 37 CFR 1.83(a).

Specification Objection

The Examiner also objects to the Specification due to various informalities. In view of the amendments to the Specification as shown in the Substitute Specification, and the new Abstract included in this Amendment, Applicant respectfully submits that the objections are overcome.

For example, the Examiner objects to the Specification by stating that Page 5, line 26 of the Specification recites “time and change over switch (30 & 31) and line 27 of the same page recites “a hydrogen gas inlet (31). It is unclear what 31 does.

In this regard, it Applicant respectfully submits that Fig 4 discloses a control panel (29) with time and change over switches (30 & 31) to control the selection of cylinders (7a) as desired. The outlets (1) (as shown in FIG. 2) that originate from cylinders (7a) and carry hydrogen gas are connected to “T” connection or joint (36b and 36c). The “T” connection is further connected to a pipe through a control valve (32) through a connection (36a). The hydrogen flow rate through the pipe is regulated by hydrogen pressure regulator (33). The regulated hydrogen gas is controlled by means of valves (34) and (35) prior to the down stream use.

Applicant submits that reference character (31) is a switch to select a desired cylinder (7a). The selected container (7) of the cylinder (7a) having encapsulated metal hydride shells (2) is used for the disintegration of the shells (2) and consequential hydrogen gas generation. The switch (31) is used to select the desired cylinders (7a), when they are connected in series, for the production of hydrogen gas.

As such, Applicant believes the function of reference numeral 31 is clear. Also, page 5, lines 27-29 of the Specification have been suitably amended by providing the details of the connectivity of “T” connections. Applicant notes that no new matter is being added.

With respect to the other objections, Applicants note that appropriate corrections have been made in the Substitute Specification.

In view of the above, Applicant believes that all the required corrections as indicated in Pages 3-4 of the Office Action, have been corrected. Accordingly, withdrawal of this objection is respectfully requested.

Claim Objections

Claims 1, 7, 23, and 26 are objected to due to various informalities. In view of the clarifying amendments being submitted herewith, Applicant submits that the objections are overcome.

Claim Rejections - 35 U.S.C. § 112, first paragraph

Claims 1, 10, and 17 are rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement. Applicant traverses the rejection for the following reasons.

Specifically, the claim 1 rejection is directed to feature (h), wherein it is alleged that the limitation “a motion transmitting element mounted on the ramming means connected to outer baffles to provide a corresponding rotatable action to the container,” is not described in the specification.

Applicant respectfully submits by referring to Figs 2 and 3 of the accompanied drawings, in a non-limiting embodiment of the hydrogen production system of the claimed invention,

rotatable containers (7) filled with encapsulated metal hydride shells (2) are used for production, storage and dispensation of hydrogen gas. In the non-limiting embodiment, in order to produce hydrogen gas, by directing the flow of the encapsulated metal hydride shells (2) from the rotatable containers (7) into the disintegrating sites (25) of cylinders (7a) filled with water, a plurality of inner (17) and outer baffles (19) are which are connected to rotatable containers (7) and cylinders (7a) respectively are used to cause the rotation containers (7). This movement of the baffles (17 & 19) is caused by motion transmitting elements (22a), which in the non-limiting embodiment are levers that are connected to movable ramming members (11a). The motion transmitting elements (22a) are further connected to the movable ramming members (11a) and to outer baffles (19). The axial and reciprocal movements of the movable ramming members (11a), is transmitted to the motion transmitting elements (22a) (levers), which is further converted into the rotary motion of the rotatable containers (7) by means of the outer baffles (19), which are connected to the motion transmitting elements (22a) on one side and the rotatable containers (7) on the other side. The inner baffles (17) that are disposed inside the containers (7), direct the encapsulated metal hydride shells (2) form the containers (7), during the course of the rotation of the rotatable containers (7), into disintegrating sites (25) for their disintegration by means of pistons (11) connected to movable ramming members (11a) and release the metal hydride into water (6). The released metal hydride reacts with water (6) to produce hydrogen.

Accordingly, Applicant believes that the description as provided reasonably conveys to one skilled in the relevant art, the possession of the relevant features of the claimed invention, especially, the arrangement of the movable ramming members (11a) in conjunction with the other connected elements of the system of the claimed invention.

In this regard, applicants also amend page 5 of the Specification (e.g., see redlined version of Substitute Specification). Applicant further submits that, while undertaking the amendments, no new subject matter is added.

Claim 10 is rejected under 35 U.S.C 112, first paragraph, as failing to comply with the written description requirement. More specifically, the limitations “a hydraulic pack”, and “hydraulic cylinders” are not described in the specification.

In continuation of the foregoing, Applicant respectfully further submits by referring to Figures 1 & 3 of the accompanied drawings, the hydraulic power means as used in the non-limiting embodiment, is a general hydraulic power pack mechanism, that includes a driving member, which is generally a motor (4) and driven members such as movable hydraulic cylinders (26a and 26b). The movable hydraulic cylinders (26a and 26b) are provided with reciprocal hydraulic displacement. A reservoir (not shown in the figures), which is generally provided in hydraulic pack arrangements, to hold hydraulic liquid and pump is also used to circulate the hydraulic fluid to lubricate the moving parts of the hydraulic mechanism.

Accordingly, in the non-limiting embodiment, the hydraulic power pack includes a motor (4) to provide reciprocal displacement of to movable hydraulic ramming members (11a) with pistons (11). The hydraulic power pack employs a reservoir and a pump (not shown in the figures) connected to the movable hydraulic ramming members (11a). The movable ramming members (11a) are provided with hydraulic cylinders (26b), to impart to and fro motion for the ramming members (11a) by the reciprocal displacement of the cylinders. The hydraulic liquid as present in the reservoir is used to lubricate the moving parts of the hydraulic mechanism. The hydraulic cylinders (26b) are also provided with suitable sealing mechanism to prevent leakage during the reciprocating motion of the pistons (11). Therefore, in this non-limiting embodiment,

the hydraulic pack is used as adopted by the Applicant, is a general hydraulic system to exert a reciprocal drive to the ramming members (11a).

Applicant has also amended claim 1 by incorporating the feature of “hydraulic power means”, which has support in the written description read along with Figs. 2 & 3 of the drawings.

Since claim 17 has been canceled, the rejection thereto is rendered moot.

Claim Rejections – 35 U.S.C. § 112, second paragraph

Claims 1, 10, 18, 19, 22, 23, and 27 are rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. Applicant traverses this rejection as follows.

In view of the self-explanatory amendments to claims 1, 10, 19, 22, and 23, Applicant submits that the claims comply with the requirements of 35 U.S.C. § 112. Since claim 27 has been canceled, the rejection thereto is rendered moot.

Claim 18 is rejected as allegedly having insufficient antecedent basis for the limitation “the intervening gaps”. The limitation “intervening gaps”, as shown in Fig 2, is used to show the formation of gaps among the encapsulated metal hydride shells to provide additional space for the storage of hydrogen. Feature (b) of claim 1 is suitably amended, by incorporating the limitation “intervening gaps” and claim 18 is also suitably amended to reflect the antecedent basis.

Claim 19 is also rejected under 35 U.S.C 112, second paragraph, as allegedly being incomplete for omitting essential structural cooperative relationships of elements, more specifically the hydraulic power means having a hydraulic seal is placed at the bottom of the system ... to have a multi-container dispensing system.

The hydraulic power means as claimed in claim 19 is a hydraulic mechanism, which is described by referring to **Figs 2 & 3**. As explained above with respect to the drawings objection

and the 35 U.S.C. § 112, first paragraph rejection, the hydraulic pack as used in a non-limiting embodiment of the claimed invention is a general hydraulic device including a sump containing a hydraulic fluid and pump, which is driven by a motor (4) and connected to movable ramming members (11a) with pistons (11) to provide a reciprocal movement to the movable hydraulic ramming members (11a). The movable ramming members (11a) include hydraulic cylinders (26b), to impart to and fro motion for the ramming members (11a). The hydraulic cylinders (26b) are also provided with suitable sealing mechanism to prevent leakage during the reciprocating motion of the pistons (11). The reciprocal movement of the hydraulic ramming members (11a) is regulated by the control panel (29) depending on the flow requirement of the hydrogen gas, by disintegrating the encapsulated metal hydride shells (2) with pistons (11) of said hydraulic ramming members (11a). The hydraulic ramming members (11a) are connected to each of the containers (7), which are disposed inside the cylinders (7a). The reciprocal movement of the hydraulic ramming members (11a) is regulated by the control panel depending on the flow requirement of the hydrogen gas, by disintegrating the encapsulated metal hydride balls (2) with pistons of the hydraulic ramming members (11a). Therefore, the non-limiting embodiment can be adapted to have a connection of multiple-cylinders connected to and operated by the hydraulic ramming members (11a) for the production of hydrogen gas.

In view of the foregoing, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 112 rejection of claims 1, 10, 18, 19, 22, and 23.

Claim Rejections -35 U.S.C. § 103

Claims 1, 4-9, 11, 12, 14, 16-18, 21, 22, and 27 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over U.S. Patent No. 5,817,157 to Checketts, in view of U.S. Publication No. 2004/0047801 by Petillo *et al.* ("Petillo"), U.S. Patent No. 4,543,246 to Houser,

U.S. Patent No. 7,181,906 to Dalla Betta *et al.* ("Dalla Betta"), and U.S. Patent No. 4,466,808 to Koog.

Applicant respectfully traverses this rejection for the reasons noted below. In particular, the Office Action asserts (from pages 7-9) that:

[(1)] **Checketts** teaches that hydrogen generation system comprising: at least a sealed and replaceable cylindrical housing 52 filled with water having top plate 55, mounted vertically on a bottom cover 54 (Figures 5 and 7-9; column 10, lines 3-8 and lines 23-25. (Office Action at page 8, lines 1-3).

[(2)] **Checketts** teaches that the cylindrical container 52 bottom portion stores encapsulated hydride pellets and is refilled by a straight refilling tube 105 (Figures 5-6). A bank of cells that contains individual coated pellets formed of sodium or another suitable alkali metal or metal hydride (Figure 1; Column 3, lines 50-58) is preferably arranged to be easily and quickly removed, when expended, and replaced with fully charged system (Column 4, lines 38-41).

[(3)] **Checketts** teaches that the top cover 55 for closing over the cylinder top end in sealing engagement therewith and may be removable (Column 10, lines 3-8); the hydrogen generator 51 includes a spherical pellet loading arrangement and is installed inside the cylindrical housing 52 (Figs 5 and 6).

[(4)] **Checketts** teaches that a bottom plate 81 disposed at the bottom end of the cylinder is fixed to the inner surface of the cylinder as shown (Figures 5 and 7-9).

[(5)] **Checketts** teaches that the bottom plate 81 has a feed tube 91 that provides a passage for the spherical pellets to float upwardly and out from a top end 91b

thereof and into a reactor chamber 92a in the cylinder (Figures 7-9; column 11, lines 34-37).

[(6)] **Checketts** teaches that the reactor piston 92 disposed at the end of the passage extends into the reactor chamber 92a (“a disintegrating site), urging the spherical pellet therein against sharp edge 95 of the reactor blade 94 to cut the pellet in half. The two pellet halves then float out into water (Figure 9; column 11, lines 41-49).

[(7)] **Checketts** teaches that the hydrogen outlet 61 is disposed on the top cover 55 (Figure 7).

[(8)] **Checketts** teaches that the computer system to control the operations of the system (column 4, lines 5-8 and 32-41).

[(9)] **Checketts** does not expressly teach a rotatable container fixed to inner surface of the cylinder on both the sides by supporting rings with rollers. However, Petillo et al teaches a rotary cylinder as a dispensing device. Therefore, it would have been obvious to use a rotatable container fixed to the inner cylinder on both sides by supporting rings as shown in Checketts.

[(10)] **Checketts** does not expressly teach a lid having a moist separation mesh. However, it is obvious to try since metal hydride is reactive with moisture in air and a moist separation mesh is useful in preventing such an unwanted reaction.

[(11)] **Checketts** does not expressly teach a slide base member fixed to inner surface of the cylinder on both sides by supporting rings. However, it is stated that considering the teachings of Houser, it would have been obvious by turning the Checketts system up-side-down and following the teachings of Houser’s demonstration of balls rolling by gravity.

[(12)] Checketts does not expressly teach a plurality of baffles disposed both inside and outside periphery of the rotatable container. However, it is stated that in the light of teachings of Dalla Betta et al., and Koog, it would have been obvious to use the baffle arrangement.

[(13)] Checketts does not expressly teach using optionally a plurality of cylinders and containers connected in series for hydrogen production, storage and dispensation, which is subject matter of claims 4 and 22. However, it is stated that such an arrangement would have been obvious in the light of teachings of Checketts.

[(14)] Checketts teaches hydrogen generation system made of steel as claimed in claim 5.

[(15)] Checketts teaches a movable piston 92 and reactor chamber 92a that facilitate the disintegration of the metal hydride pellets as claimed in claim 6.

[(16)] Checketts teaches use of pellets of alkali metal hydride as claimed in claims 7 and 21.

[(17)] Checketts teaches that the pellets are shaped into a sphere, cube or like shape as claimed in claim 8.

[(18)] Checketts teaches that the pellets are coated with a flexible plastic, such as high density polyethylene as claimed in claim 9.

[(19)] Checketts teaches that the bank of cells that contains pellets as claimed in claim 11.

[(20)] Checketts teaches that the control panel is a computer as claimed in claim 12.

[(21)] Checketts does not expressly teach that baffles are used to provide an uninterrupted flow of encapsulated metal hydride materials into disintegration site as claimed in claim 14. However, it is obvious over the teachings of Dalla Betta et al.

[(22)] Checketts teaches that the coated pellets react with water in cylinder to produce hydrogen as claimed in claims 16 and 18.

[(23)] Checketts teaches that reactor piston 92 can be directed to crush the metal hydride as claimed in claim 17.

[(24)] Checketts does not expressly teach the use of low and high density encapsulated metal hydride shells as claimed in claim 27. However, it is stated it would have been obvious over the teachings of Checketts and Petillo et al.

Applicant respectfully disagrees. Applicant respectfully submits that each of the foregoing statements identified as [(1)]-[(24)] are inaccurate or a misunderstanding, which forms the basis of the obviousness rejection.

Applicant addresses each inaccuracy in order below. Before, each of statements of the Office Action is addressed, Applicant provides an explanation for highlighting the distinguishing features of the system of the Applicant's claimed invention vis-à-vis Checketts system below.

Checketts discloses a hydrogen generation system with a fixed and non-rotatable cylinder 52, which is filled with water 62 and inserted into a tube 53 having top and bottom covers 54 and 55 and closed with top cover 55. A refilling tube 105 is used to supply spherical pellets into the bottom space of the cylinder 52 and mobilized further in upward direction through another tube 91. The spherical balls transported up to reactor chamber 92a, wherein a cam operated piston with a chisel, slices the spherical balls to release the contents into the water 62 and the contents react with water to produce hydrogen. It is also seen here that the top cover tube 53 containing

the broken pieces of plastic, NaOH and water needs to be opened to draining these materials. In this cited patent reference, the spherical balls are maintained in the water 62 even before they are sliced.

On the other hand, the system for production of hydrogen gas of the Applicant's claimed invention employs rotatable containers (e.g., 7) fitted into cylinders (e.g., 7a) as storage for the encapsulated metal hydride shells (e.g., 2) and are sealed. Slider base members (e.g., 22) with passages (e.g., 21) fixed to the cylinders (e.g., 7a) act as bottom for the containers (e.g., 7). A plurality of baffles (e.g., 17&19) provided both inside and outside of the containers (e.g., 7), which include a set of outer baffles (e.g., 19) that are connected to the containers (e.g., 7). The outer baffles (e.g., 19) are further connected to motion transmitting elements (e.g., 22a), by means of which the outer baffles (e.g., 19) provide a rotary motion to the containers (e.g., 7). The containers (e.g., 7) also include an inner set of baffles (e.g., 17) that are provided to regulate and direct the flow of the encapsulated metal hydride shells (2) through the passages (e.g., 21). The cylinders (e.g., 7a) as used in the claimed invention are provided with conical bottoms with valves (e.g., 27) for releasing the by products including broken pieces of encapsulated metal hydride shells (e.g., 2), NaOH and water (e.g., 6).

In the claimed invention, cylinders (e.g., 7) can also be connected and arranged in series so as to provide a continuous supply of hydrogen, by switching over to the other available cylinders (7), whenever required by a user.

In the claimed invention, the containers (7) are also provided with sufficient space so as to contain enough quantity of hydrogen gas at the required pressure for continuous and smooth supply.

In contradistinction to Checketts, in the claimed invention, the encapsulated metal hydride shells (2) are only stored in the container (7) and are not maintained in water (6) before they are disintegrated. This is to provide an additional safety measure by preventing unnecessary exposure of unbroken metal hydride shells to water (6).

The distinguishing features of system of the claimed invention vis-à-vis the system as disclosed in Checketts are summarized and listed below:-

- (i) Checketts discloses a non-rotatable tube for storing and mobilizing the spherical balls whereas in the system of the Applicant's claimed invention, no such tube is used to store and mobilize the encapsulated metal hydride shells. In contradistinction, rotatable containers, which are sealed, are used to store encapsulated metal hydride shells. The rotatable containers (7) are provided with bottom passages (21) to permit the passage of encapsulated metal hydride shells (2) from the containers (7) into the disintegrating sites (25).
- (ii) Checketts discloses a feeding mechanism of the spherical balls, wherein the spherical balls are mobilized from the bottom of the tube to another tube in a vertical motion before they are brought to reactor chamber for slicing. However, in the system of the Applicant's claimed invention no such mechanism is used and the system that is adopted in the claimed invention is a gravity-based mobilization of the shells (2), actuated by the rotation of the containers (7) by means of outer baffles (19) and guided by the inner baffles (17), to the disintegration sites (25), for the disintegration of the shells (2). This unique constructional arrangement is provided to facilitate a jamming-free feed of the encapsulated metal hydride shells (2) into the disintegration sites (25).
- (iii) The actuating mechanism that is disclosed in Checketts, for mobilizing the

spherical balls in a tube, is a cam-based element, which is actuated to mobilize the balls in vertical motion in the tube, and whereas in the system of the claimed invention, no such cam-based element is used. In contra distinction, a plurality of outer baffles (19) operated by motion transmitting elements (22a) and movable ramming members (11a), which are operated by a hydraulic cylinder mechanism, wherein the reciprocating action of the cylinder, is used to actuate the baffles (19) so as to rotate the containers (7). The rotation of containers (7) facilitates the movement of the encapsulated metal hydride shells (2) into the cylinders (7) and ensures continuous feed.

With respect to the first statement in the Office Action, marked as I(1) above, a reading of Column 10, lines 3-8 and lines 23-25 along with Figures 5 and 7-9 of Checketts, shows that cylindrical housing is an open tube 53 with a bottom cover 54, containing a volume of water 62. Therefore, it is clear that tubes 53 and 91 are used as a cylindrical housing 52 whereas in the claimed invention, rotatable containers are used to store and mobilize the encapsulated metal hydride shells.

Thus, Checketts is deficient as to failing to disclose, teach or suggest the use of rotatable containers for storing and directing the encapsulated metal hydride shells, with a rotary motion of the containers, wherein the rotary motion is actuated by means of outer baffles, which in turn connected to a motion transmitting elements and a movable ramming members and the guiding of encapsulated metal hydride shells is performed by inner baffles, as claimed.

With respect to the second statement in the Office Action marked as I(2) above, a reading of Column 3, lines 50-58 and Column 4, lines 38-4 along with Figures 1 and 5-6 of Checketts, shows that cylindrical container 52 bottom portion stores encapsulated spherical metal hydride

pellets and refilled by refilling tube 105 along with an arrangement for removing the expended pellets.

The specific portions of the cited description as pointed out also clearly shows that the bottom portion cylindrical housing 52, which is a fixed one, stores the pellets, which are fed through a refilling tube 105. Further, the pellets are maintained in the water. In the System of the Applicant's invention, the containers are rotatable and no such tubes are used to feed the shells. In addition, the shells are not permitted to be maintained in the water as is the requirement of Checketts. The cylindrical container 52 as shown in Checketts is used to incorporate the tube assembly and for storing pellets in water and whereas the containers as used in the claimed invention are rotatable and shells are stored in such containers. Further, no water is stored in said containers and these shells (unbroken shells) are not permitted to reside in water. In addition, the shells are disposed to drop inside said cylinders having water, only after the shells are disintegrated. It is therefore clear that the cylindrical housing 52 as disclosed in Checketts is structurally and functionally distinct from the rotatable containers as used in the claimed invention.

With respect to the third statement in the Office Action marked as [(3)] above, it is pointed out that Column 10, lines 3-8 along with Figures 5 and 6 of Checketts, show a top cover 55 arranged for closing the cylinder top end and provides an inlet means for encapsulated metal hydride and water.

However, on reading of the specific portions of the description of Checketts, it is clear that the top cover 55 is used to cover the cylindrical housing 52 and not as inlet means for encapsulated metal hydride shells. In Checketts, a feeding tube 105 is used as inlet means for feeding the metal hydride shells into the cylinder. In the claimed invention, the encapsulated

metal hydride shells are filled through the lids of the rotatable containers and sealed subsequently and no tubes are used for feeding the encapsulated metal hydride shells as shown in Checketts.

With respect to the fourth statement in the Office Action marked as [(4)] above, it is pointed out that Figures 5 and 7-9 of Checketts, show a bottom plate 81 disposed at the bottom end of the cylinder and fixed to the inner surface of the cylinder.

On careful reading of the description of the bottom plate 81 as provided in Checketts, it is clear that bottom plate 81 with a hole 81a is used *inter alia* to connect the feed tube 91 for feeding the spherical balls and to dispose a carousel dispenser disk 85 to mount the cam arrangement and a hole 108 to include a flexible coil spring 110. Whereas, in the claimed invention, the slider base members act as bottom to the rotatable containers. The slider base members are provided with passages, and the passages are connected to slider path to transmit the encapsulated metal hydride shells from the containers into the disintegrating sites of the cylinders. It is therefore evident that the structural and functional attributes of “bottom” of the containers of the claimed invention are distinct from that of bottom plate as disclosed in Checketts.

With respect to the fifth statement in the Office Action marked as [(5)] above, it is pointed out that Figures 7-9, column 11, lines 34-37 of Checketts show a bottom plate 81 having a feed tube 91 that provides a passage for the spherical pellets to float upwardly and out from a top end 91b thereof and into a reactor chamber 92a in the cylinder.

In view of the foregoing submissions, it is clear that no such tubes to provide a passage for spherical pellets are adopted in the claimed invention. In contradistinction, passages are provided to containers and connected to a slider path to transmit the encapsulated metal hydride shells from the containers into the disintegrating sites of the cylinders.

With respect to the sixth statement in the Office Action marked as [(6)] above, it is pointed out that Figure 9, column 11, lines 41-49 of Checketts depict a reactor piston 92 disposed at the end of the passage extends into the reactor chamber 92a, urging the spherical pellet therein against the sharp edge 95 to cut the pellet in half. Two pellet halves then float out into the water.

In the claimed invention, it can be clearly seen in a non-limiting embodiment thereof in view of **Figs 2 & 3** that the movable ramming members **(11a)** (with hydraulic cylinders **26a** and **26b**) extending plane perpendicular to the rotatable containers **(7)** are disposed at the bottom end of the slider path. The ramming members **(11a)** include disintegrating sites **(25)** to receive the encapsulated metal hydride shells **(4)** from the slider. Movable pistons **(11)** connected to the ramming members **(11a)** cause the disintegration and dispersion of broken shells **(4)** and metal hydride into the cylinders **(7a)**. Further, these ramming members **(11a)** with movable pistons **(11)** and having reciprocal motion, are constructed in a manner to actuate the following functions viz., (i) rotation of the rotatable containers **(7)** in conjunction with the motion transmitting elements **(22a)** and outer baffles **(19)**, (ii) directing the metal hydride shells **(4)** by means of inner baffles **(17)** into slider paths, and (iii) to disintegrate the encapsulated metal hydride shells **(4)** at the disintegrating sites **(25)**. The reaction chamber 92a as shown in Checketts is a tubular portion where the balls are mobilized in upward direction, whereas in the claimed invention no such tubes are used for disintegrating sites **(25)**. The disintegrating sites **(25)** of the system of the claimed invention are operated by a hydraulic mechanism, which is described by referring to **Figs 2 & 3**. The ramming members **(11a)** with pistons **(11)** are operated by the hydraulic mechanism to provide a reciprocal movement. The movable ramming members **(11a)** include hydraulic cylinders **(26b)**, to impart to and fro motion for the ramming members **(11a)**. The ramming members **(11a)** are provided with disintegrating sites **(25)** that include hollow cavities

(24). The disintegrating sites are disposed to receive the encapsulated metal hydride shells (2) from the rotatable containers, which are located above the disintegration sites (25) and shells (2) are permitted into the disintegration sites by means of gravity. Therefore, the disintegrating sites (25) of the claimed invention are hollow cavities to receive the guided encapsulated metal hydride shells (2) into them before they are disintegrated by the ramming members (11a). Accordingly, the disintegrating sites (25) of the claimed invention do not use tubular reaction chamber 92a as shown in Checketts.

In addition, no sharp edged ends are used in the movable piston of the claimed invention to cut the metal hydride shells into halves. Accordingly, the movable piston as implemented in the claimed invention is also structurally and functionally distinct from that of the reactor piston as disclosed in Checketts.

With respect to the seventh statement in the Office Action marked as [7] above, it is pointed out that Figure 7 of Checketts, discloses a hydrogen outlet 61 disposed on top cover 55.

The hydrogen outlets of the claimed invention are mounted on hollow lids of the containers and connected to control panel, in order to control the hydrogen flow rate. The hydrogen outlets that are originating from various hydrogen outlets o the cylinders are further connected to a "T" connection. The regulated hydrogen gas is sent out by means of valve for further use. Moreover, in the present system, the cylinders with hydrogen outlets are provided to ensure the continuous supply of Hydrogen and having a flexibility to replace the empty containers.

Whereas, Checketts depicts only a hydrogen outlet (61) line and does not show any of the structural arrangement of the hydrogen outlets of the claimed invention and therefore it is

submitted that hydrogen outlets **(1)** of the claimed invention are structurally and functionally distinct from that of the hydrogen outlet **(61)** as disclosed in Checketts.

With respect to the eighth statement in the Office Action marked as I(8) above, it is pointed out that column 4, lines 5-8 and 32-41 of Checketts depict a computer system to control the operations of the system.

In the system of the claimed invention, Applicant respectfully draws the attention of the Examiner to **Fig 4** of the drawings illustrating a non-limiting embodiment, wherein a control panel **(29)** with time and change over switches **(30 & 31)** are used to control the selection of the cylinders **(7a)** as desired by switching over to the desired cylinders **(7a)** that are connected in series. The control panel **(29)** of the claimed invention enables continuous supply of the Hydrogen drawn from a plurality of cylinders **(7a)** connected in series, wherein a plurality of hydrogen outlets **(1)** are connected through a 'T' joint to a pressure and flow regulator. In addition, the Control Panel **(29)** as used in the claimed invention to control the operating pressure and flow rates, which help use the system for different user requirements.

In view of the above, Applicant submits that no such computer system as disclosed in Checketts, is adopted in the claimed invention.

With respect to ninth statement in the Office Action marked as I(9) above, it is stated that Checketts does not expressly teach a rotatable container fixed to inner surface of the cylinder on both the sides by supporting rings with rollers. However, Petillo et al teaches a rotary cylinder as a dispensing device. Therefore, it would have been obvious to use a rotatable container fixed to the inner cylinder on both sides by supporting rings with rollers as shown in Checketts.

In particular, the Office Action asserts (pages 9-10) that Petillo et al. teaches about the generation of hydrogen gas by hydrolysis reactions of complex metal hydrides and teaches a rotary cylinder as a dispensing device (Page 1, Paras 1, 2 and 7). Therefore, it would have been obvious to try the rotatable container fixed to the inner of the cylinder on both the sides by supporting rings with rollers in Checketts' hydrogen generating system motivated by Petillo's teaching that rotational cylinder or container driven by a motor or air driven wheel rotates one or more times so that it provides a predetermined amount of solid component to combine with liquid component in a chamber (page 4, Para 38) and thus controls the rate of the reaction.

It is respectfully submitted that the above statement [9], which forms the basis of the obviousness rejection, is inaccurate or a misunderstanding. Applicant addresses the inaccuracy as below.

Petillo et al. discloses a hydrogen generation system comprising a rotatable cylinder 220 with a trough 226, wherein the cylinder is rotated such that the trough 226 overlaps an opening 215 of the connecting storage tank 101 thereby enabling the transfer of solid fuel into the storage tank 101.

Considering the foregoing submissions, Applicant further submits that in the system of claimed invention, the rotatable containers with bottom passages are filled encapsulated metal hydride shells and the containers are sealed. Slider base members are fixed to the cylinders. Baffles are provided to rotate the containers and guide the encapsulated metal hydride shells and to initiate the shells into the passages and rotate the containers. The baffles are actuated by axial movement of the ramming members. The feed rate of the shells is controlled based on the pressure and flow rate of the hydrogen to the down stream machines. Therefore, the

arrangement of rotatable containers in the claimed invention is entirely different from that of the rotatable cylinder as shown in Petillo et al.

Therefore, it is evident from the above that the arrangement of rotatable cylinder 220 as disclosed in Petillo et al does not teach, suggest or motivate the constructional arrangement of the sealed containers with bottom passages that are filled with encapsulated metal hydride shells. Petillo et al. also does not teach or suggest slider base members with passages fixed to cylinders and a plurality of baffles provided to initiate the shells into the bottom passages and to rotate the containers.

With respect to tenth statement in the Office Action marked as I(10) above, wherein it is stated that moist separation mesh is not explicitly disclosed but it is obvious to try and have a moist separation mesh, since metal hydride is reactive with moisture in air and a moist separation mesh is useful in preventing such an unwanted reaction.

The moist separation mesh in the claimed invention is arranged on top of the rotatable containers in the meeting area of the lids and cylinders, which is neither taught nor suggested by Checketts. Further, there exists no motivation from the teachings of Checketts to arrive at the moist separation mesh as arranged in the Applicant's claimed invention.

With respect to eleventh statement in the Office Action marked as I(11) above, it is stated that Checketts does not expressly teach a slide base member fixed to inner surface of the cylinder on both sides by supporting rings. However, it is stated that considering the teachings of Houser, it would have been obvious by turning the Checketts system up-side-down and following the teachings of Houser's demonstration of balls rolling by gravity.

In particular, the Office Action asserts (pages 10-11) that:

(a) Houser discloses a method and apparatus where the balls roll by gravity through ball opening 18, down ball return guide 19, through ball receiver chamber 21, passage 26 to a ball feeder 16 and therefore it would have been obvious to one of ordinary skill in the art at the time of invention to have turned Checketts' hydrogen system up-side-down so that the container of metal hydroxide pellets would be on top and used a slider base member to provide a passage or a slider path to transmit the encapsulated metal hydride pellets from the container into the cylinder, motivated by Houser's demonstration that balls rolling by gravity from one chamber to the next simplifies the machinery of hydrogen gas generator and that the balls can be guided into a desired location by directing means such as the down ball return guide, the inclining path and the passage.

(b) It would have been obvious to one of ordinary skill in the art at the time of invention to have turned Checketts' hydrogen generation system up-side-down so that the container of metal hydride pellets would be on the top and used a slider base member to provide a passage or a slider path to transmit the encapsulated metal hydride pellets from the container into the cylinder.

Unfortunately, each the foregoing statements based on Houser, which forms the basis of the obviousness rejection is inaccurate or a misunderstanding. Applicant addresses each inaccuracy in order below.

Houser teaches a method and apparatus where the balls 12 are rolled on an inclined surface against gravity and exposed to a spray of reactant (NaOH solution or water) through nozzles 13, so as to expose the balls 12 to a sufficient reaction time and allowed to fall through an opening 18 into a chamber 21. The unreacted balls are recycled using rotary feeder 16.

Further, balls exit from the reaction chamber 11 through opening 18 and travel by gravity along ball return guide 19 into and through ball receiver chamber 21.

In the claimed invention, the rotatable containers with slider base members acting as bottom having passages are filled encapsulated metal hydride shells followed by the sealing of the containers. A plurality of baffles actuated by motion transmitting elements (levers) are provided to rotate the containers and to guide the shell into the passages. The rotation of the containers is actuated by means of the ramming members, having hydraulic cylinders. The reciprocal motion of the ramming members (11a) is converted into rotary motion by the motion transmitting element. The system of the claimed invention is different from what is disclosed in Houser in that that slider paths as used in the claimed invention, are for the gravity-based guiding of metal hydride shells into the disintegrating site for disintegration and dispersing the reactant (metal hydride) into water to produce hydrogen. The slider paths as used in the Applicant's claimed invention, receive the shells from the rotatable containers and permit them into disintegrating sites. Whereas, in Houser, the inclined perforated channels 15 are used in conjunction with ball feeder 16 to transport the balls and expose them to spray of reactants. Accordingly, the perforated channels 15 and guide 19 as used in Houser are different from that of the slider paths as used in the claimed invention. Therefore, it is respectfully submitted that Houser does not teach, suggest or motivate a person having ordinary skill in the art to arrive at the above-stated arrangement of the Applicant's invention.

It is also respectfully submitted that the Examiner's assertion that the apparatus of the claimed invention becomes obvious by turning the apparatus as disclosed in Checketts' up-side-down and the demonstration of rolling of the balls by gravity in Houser, cannot be sustained on the following grounds:

- (i) Checketts discloses a non-rotatable tube for storing and mobilizing the spherical balls and whereas in the claimed invention rotatable containers, which are sealed, are used to store encapsulated metal hydride shells. The rotatable containers are provided with bottom passages to permit the passage of encapsulated metal hydride cells from said containers into cylinders filled with water.
- (ii) Checketts discloses a feeding mechanism of the spherical balls, wherein the spherical balls are mobilized from the bottom of the tube to another tube in a vertical motion before they are brought to reactor chamber for slicing. However, in the claimed invention no such mechanism is used and the mechanism that is adopted in the claimed invention is a gravity-based mobilization of the shells to the disintegration site, which facilitates a jamming-free feed system of the encapsulated metal hydride shells (2).
- (iii) The actuating mechanism that is disclosed in Checketts, for mobilizing the spherical balls in a tube, is a cam-based element, which is actuated to mobilize the balls in vertical motion in the tube, and whereas in the system of the claimed invention, no such cam-based element is used. In the system of the claimed invention, a plurality of outer baffles operated by a hydraulic cylinder mechanism, wherein the reciprocating action of the hydraulic cylinder is used to rotate the containers in conjunction with the baffles, so as to permit the movement of the encapsulated metal hydride shells to drop into cylinders and to ensure continuous feed.
- (iv) Houser teaches a method and apparatus where the balls 12 are rolled on a inclined surface against gravity and exposed to a spray of reactant (NaOH solution or water) through nozzles 13, so as to expose the balls 12 to a sufficient reaction time and allowed to fall through an opening 18 into a chamber 21. The unreacted balls are recycled using

rotary feeder 16. Whereas, in the Apparatus of the claimed invention, the containers with a bottom hole is filled encapsulated metal hydride shells and the containers are sealed. The slider base members with passages are fixed to the cylinders. A plurality of baffles provided to initiate the shells into the passages and to cylinders. Therefore, the claimed invention is different from what is disclosed in Houser, in that a slider path is adopted, which facilitates the guiding of metal hydride shells.

In view of the above, it is evident that even after having the knowledge of the structural construction of the apparatus as disclosed in Checketts, it would not have been possible to arrive at the construction of the apparatus of the claimed invention, even if the apparatus as shown in Checketts were to be turned up-side down, since the constructional features of the apparatus of the claimed invention are physically distinct from that of the features as shown in Checketts. Further, it is respectfully submitted that if the apparatus as disclosed in Houser is turned upside down, by positioning the storage of balls in the upper region of the cylinder, a skilled artisan cannot find any means that could possibly direct the balls into the reaction chamber.

In addition, if one were to go by the proposed modification of the Examiner, the mere turning of the Apparatus of Checketts up-side-down would only result in a device, where unbroken balls are allowed to float in the water of a cylinder and the balls are permitted to reside in tubes and hydrogen gas is produced at the bottom of the cylinder.

It is respectfully submitted here by considering the foregoing submissions, that Applicant has neither visualized nor implemented such an arrangement as alleged by the Examiner, in the system of the claimed invention. The Applicant's claimed invention neither adopts a system where tubes are used for storing the balls nor the balls are allowed to reside in water before they are disintegrated to produce hydrogen.

It is also evident from the above, that the apparatus as disclosed in Houser does not depict the system of the claimed invention, where the rotatable containers are filled encapsulated metal hydride shells and the containers are sealed. The slider base members with passages are fixed to said cylinders. A plurality of baffles provided to initiate the shells into the passages and to rotate the containers. Therefore, the claimed invention is different from what is disclosed in Houser wherein a slider path is adopted, which facilitates the guiding of metal hydride shells.

The Applicant respectfully submits that the combined teachings of Checketts and Houser do not teach or suggest the construction of hydrogen generation system of the present system with rotatable and sealed containers used to store encapsulated metal hydride shells, wherein the rotatable containers are provided with bottom passages to permit the passage of encapsulated metal hydride cells from said containers into cylinders filled with water after their disintegration. A gravity-based mobilization of the shells to the disintegration sites is used in the claimed invention, which facilitates a jamming-free feed system of the encapsulated metal hydride shells. The rotation of the containers is achieved by using a plurality of outer baffles operated by a hydraulic cylinder mechanism, wherein the reciprocating action of the hydraulic cylinder is used to rotate the containers in conjunction with the baffles, so as to permit the movement of the encapsulated metal hydride shells to drop into cylinders and to ensure their continuous feed.

Even further, there is no motivation to combine Checketts with Houser because Checketts is directed to an a hydrogen generating system, wherein a set of tubes are used as conduit for transporting the pellets and the pellets are permitted to reside in the water (in unbroken condition). Further, pellets are worked from bottom to top through said tubes before they are disintegrated. On the other hand, Houser discloses a gas generator where the balls are moved up a slider and exposed to spray of liquid reactant. Moreover, because Checketts does

not disclose, teach or suggest the adoption of rotatable containers having metal hydride shells, wherein said rotatable containers are rotated by means of external baffles and the metal hydride shells are guided to the disintegrating site by means of internal baffles, the combination of Checketts with Houser does not and could not have arrived at Applicant's claimed invention.

Even further, there is no motivation to combine Checketts with Houser because Checketts is directed to an hydrogen system wherein tubes are used to transmit the balls whereas Houser discloses a gas generator where the balls are moved up a slider and exposed to spray of liquid reactant.

With respect to twelfth statement in the Office Action marked as (12) above, it is stated that Checketts does not expressly teach a plurality of baffles disposed both inside and outside periphery of the rotatable container. However, it is stated that in the light of teachings of Dalla Betta, and Koog, it would have been obvious to use the baffle arrangement.

In particular, the Office Action asserts (pages 11-12) that:

- (1) Dalla Betta relates to devices and method for generating H_2 and CO in an O_2 containing gas stream and those for reduction of NO_x emissions from lean burn engines. Dalla Betta employs baffles and partitions inside a fuel processor unit to direct the desired amount of flow through the rotating fuel processing catalyst.
- (2) It would have been obvious to one of ordinary skill in the art at the time of invention to have used a plurality of baffles disposed on the inside of the rotatable container in Checketts in order to direct the desired amount of encapsulated metal hydride shells through the rotating container just as the gas stream is directed to flow through the rotating fuel processing catalyst taught by Dalla Betta et al.

Unfortunately, the foregoing statements which are based on Dalla Betta and forms the basis of the obviousness rejection, are inaccurate or a misunderstanding. Applicant addresses each inaccuracy in order below:

- (a) Dalla Betta teaches a fuel processor 60 in an emission control system having a fuel processor unit 82 in which a portion of the exhaust stream is diverted to the fuel processor catalyst 85. The fuel processing unit 62 includes baffles and partitions inside the main chamber 86 to direct the desired amount of flow through the fuel processing catalyst.
- (b) The cited reference without any specific depiction of the arrangement of the baffles, tries to direct the desired amount of flow of exhaust gases through the fuel processing catalyst 85. Therefore, it appears from the disclosure that such an arrangement of baffles or partitions are used to provide a higher surface area for fuel to flow through the catalyst.
- (c) However, in the claimed invention, the inner and outer baffles are not implemented to provide a higher surface area but to rotate the rotatable containers and to regulate the flow of the metal hydride shells (2) by providing an effective partition between the shells and to direct the shells to the reaction chamber.

The Applicant, respectfully submits that the combined teachings of Checketts and Dalla Betta do not teach or suggest the construction of hydrogen generation system of the present system with rotatable and sealed containers used to store encapsulated metal hydride shells, wherein the rotatable containers are actuated by both inner and outside baffles to rotate the containers and to direct the encapsulated metal hydride shell from said containers into cylinders filled with water after their disintegration. In other words, the rotation of the containers is

achieved by using a plurality of outer baffles operated by a hydraulic cylinder mechanism, wherein the reciprocating action of the hydraulic cylinder is used to rotate the containers in conjunction with the baffles, so as to permit the movement of the encapsulated metal hydride shells to drop into cylinders and to ensure their continuous feed.

The Applicant respectfully submits that the combined teachings of Checketts and Dalla Betta do not teach or suggest the construction of hydrogen generation system of the present system and the combination of Checketts with Dalla Betta could not have arrived at Applicant's claimed invention.

In this regard, the Examiner asserts on page 12 of the Office Action that:

- (1) Koog relates to an apparatus and a method of cooling hot gases containing CO, H₂, and non-gaseous components.
- (2) Koog employs a dip tube bearing on the outer surface a plurality of baffles that impart to assist in heat transfer and to coalesce the liquid as the gas exits the apparatus.
- (3) It would have been obvious to one of ordinary skill in the art at the time of invention to have used a plurality of baffles on both inside and outside of the rotatable container in Checketts hydrogen generation system not only to direct the desired amount of encapsulated metal hydride shells through the rotating container by inner baffles as demonstrated by Dalla Betta et al but also cools the hot hydrogen gas and possibly condenses water vapors as the reaction generates a large amount of hydrogen gas and heat at the same time as suggested by Koog.

The foregoing statements which are based on Checketts, Dalla Betta and Koog and form the basis of the obviousness rejection, are inaccurate or a misunderstanding. Applicant addresses each inaccuracy in order below:

Koog teaches a cooling apparatus for cooling hot gases containing particles passing through a viscous, sticky phase on cooling. Accordingly, baffles are mounted in the inner perimetric surface of the dip tube and the baffles may extend the passageway to provide a centrifugal force for the particles and assist in heat transfer, which helps in the separation of the solids.

It is therefore evident that Koog discloses the use of baffles, which are mounted on a dip tube, which impart to the ascending stream of gas and liquid a velocity to subject the liquids and solids to centrifugal force and they are used to assist heat transfer. In the Applicant's claimed invention, a plurality of inner and outer baffles are used to cause (i) rotary motion of rotatable container (ii) to direct the encapsulated metal hydride shells to drop into cylinders and (iii) to ensure the continuous feed of encapsulated metal hydride shells into the cylinders.

For at least foregoing reasons, Applicant submits that Koog does not teach or suggest the Applicant's claimed feeding mechanism of encapsulated metal hydride shells in conjunction with plurality of inner and outer baffles. Further, there exists no motivation for arriving at the above-stated configuration of feed mechanism, since the use of baffles in Koog was for heat transfer and whereas in the Applicant's claimed invention, baffles are used for actuating the rotation of containers and to direct the encapsulated metal hydride shells.

With respect to thirteenth statement in the Office Action marked as [13] above, Checketts does not expressly teach a plurality of cylinders as claimed in claims 4 and 22 but obvious in the light of Checketts.

In view of the foregoing submissions, Applicant respectfully submits the system as used in the Applicant's claimed invention adopts a combination of container-cylinder configuration, which is novel and inventive and not obvious over the disclosure of Checketts. Further, none of

the cited references teach, suggest or motivate the usage of plurality of cylinders, since in order to achieve the plurality of connectivity the Applicant has adopted the arrangement a unique arrangement of hydraulic pack along with ramming members and control system to generate Hydrogen at the required pressure and flow rate.

With respect to fourteenth statement in the Office Action marked as [(14)] above, it is stated that Checketts teaches hydrogen system with steel cylinders as claimed in claim 5.

Applicant respectfully submits that the subject matter of Claim 5, which is dependant from claim 1, is directed to a material for the container as claimed in claim 1. Checketts does not disclose or teach the rotatable container as used in the Applicant's claimed invention, which is the subject matter of claim 1; the subject matter of claim 5 is novel and inventive.

With respect to sixteenth statement in the Office Action marked as [(16)] above, claims 7 and 21 are rejected as Checketts teaches that the pellets are formed of alkali metal or metal hydroxide and pellets are coated with aluminum or like metal.

Applicant respectfully submits that the subject matter of Claims 5 and 21, which are dependant on claims 1 and 20, respectively, are directed to use of metal hydride shells. In view of the consideration of the fact that the subject matter of the claim 1, which is directed to a system for production of hydrogen and claim 21, which is directed to a method of production of hydrogen, are not disclosed by Checketts, the subject matter of claims 7 and 21, which are dependant on Claim 1 and 21 are patentable *at least* by virtue of their dependency. .

With respect to seventeenth statement [(17)] in the Office Action marked as above, claim 8 is rejected as Checketts teaches that the pellets are shaped into a sphere, cube, or like shape.

Applicant respectfully submits that the subject matter of Claim 8, which is directed to the shapes of encapsulated metal hydride shells, is used in conjunction with novel and inventive

system of the claimed invention and hence the subject matter of claim 8 read along with Claim 1 does not stand disclosed or suggested in Checketts.

With respect to eighteenth statement in the Office Action marked as [(18)] above, Claim 9 is rejected as Checketts teaches that the pellets are coated with a flexible plastic.

Applicant respectfully submits that the subject matter of Claim 9, which is directed to coating of encapsulated metal hydride shells, is used in conjunction with novel and inventive system of the claimed invention and hence the subject matter of claim 9 read along with Claim 1 does not stand disclosed or suggested in Checketts.

With respect to twentieth statement in the Office Action marked as [(20)] above, Claim 12 is rejected as Checketts teaches that the control panel is a computer.

Applicant respectfully submits that the subject matter of Claim 12, which is directed to use of computer as control panel, is used in conjunction with novel and inventive system of the claimed invention as claimed in claim 1 and hence the subject matter of claim 12 read along with Claim 1 does not stand disclosed or suggested in Checketts.

With respect to twenty first statement in the Office Action marked as [(21)] above, Claim 14 is rejected as Checketts does not expressly teach use of baffles and is obvious in the light of disclosure by Checketts and Dalla Betta.

Applicant respectfully submits that the subject matter of Claim 14 does not stand disclosed or suggested in combined teachings of Checketts and Dalla Betta, in view of the foregoing submissions.

With respect to twenty second statement in the Office Action marked as [(22)] above, Claims 16 and 18 are rejected as Checketts teaches that the coated pellets react with water in

cylinder to produce hydrogen, the hydrogen gas is stored in cylinder and the intervening gaps among the pellets make up part of the cylinder.

Applicant respectfully submits in the claimed invention, the encapsulated metal hydride shells are stored in containers and they are guided into cylinder filled with water after they are disintegrated to react with water and produce hydrogen gas. Whereas, Checketts (Col 4, lines 51-54) discloses “a closed housing that is at least partially filled with water to react with pellet core The housing may be contained in same housing”.

It can therefore be seen that in the Applicant's claimed invention, separate rotatable containers are used to store the encapsulated metal hydride shells and a cylinder, which is filled water is used to react the broken encapsulated metal hydride shells. Further, in the claimed invention, the unbroken metal hydride shells are not permitted to reside in the water and only the broken shells are permitted into the cylinders and the broken pellets are collected through the bottom of the cylinders. Further, the intervening gaps among the encapsulated metal hydride shells are created in the rotatable containers as against closed housing as disclosed in Checketts.

Applicant therefore respectfully submits that the subject matter of claims 16 and 18, which are dependant of claim 1, is not disclosed or suggested in Checketts.

In view of the foregoing submissions, Applicant respectfully requests the reconsideration and withdrawal of the obviousness rejection of claims 1, 4-9, 12, 14, 16-18 and 21-22. Since claims 6, 11, and 27 have been canceled, the rejection thereto is rendered moot.

Claims 2, 3, 13, 15, 20 and 23 are rejected as allegedly being obvious under 35 USC § 103(a) in view of Petillo, Houser, Dalla Betta and Koog and US Patent No. 2721789 to Gill.

In particular, the Office Action, considering the subject matter of claims 2 and 13 asserts (pages 16) that:

1. Checketts does not expressly teach using a valve at the bottom end to control the flow of water, disintegrated shells and along with byproducts or that outlet valve is sealed only during filling.
2. Gill et al teaches using chemical residue outlet valve 20 threaded to a flushing pipe 18 in communication with a chemical residue discharge tube 24.

Gill 's invention relates to a hydrogen generator for generating hydrogen chemically at low pressures for inflating meteorological balloons. A chemical residue outlet valve 20 I operated by handle 22, which communicates with a chemical discharge tube 24. The danger of excessive pressures occurring in the generator by reason of inexperienced operator erroneously opening the flushing valve 52, the valves 52 and 20 are opened simultaneously.

In the claimed invention, an outlet at the bottom of the cylinders to release by products like NaOH, broken pieces of metal hydride and water. The control of the outlet is done by a valve.

The valve arrangement as shown in Gill's Hydrogen Generator is apparently a complex mechanism by using a handle 22 and a linkage arm 57 for flushing water valve 52 to open and close simultaneously with the opening or closing of chemical residue outlet valve 20.

It is evident that the valve as used in the Applicant's claimed hydrogen generating system, is a simple valve mechanism to release by products like NaOH, broken pieces of metal hydride and water through the outlet, and it is not used for the purposes of operating the pressure levels as indicated in Gill et al. In addition, the valve is closed during the time of filling or refilling of the cylinders and sealed thereafter.

It is respectfully submitted that the valve arrangement and its function as disclosed in Gill are different from that of the valve of the claimed invention and hence the subject of matter of the claims 2 and 13 is not disclosed by the combined references of Checketts and Gill.

Claim 3 is rejected as being obvious under 35 USC § 103(a) in view of Checketts and Gill.

In particular, the Office Action asserts (pages 16) that:

1. Checketts does not expressly teach that the lid of the cylinder is an elevated hollow lid or does the lid consist of rupture diagrams.
2. Gill teaches that the top plate 14 has some space below it for hydrogen pressure measurement by a pressure gauge 84.
3. Gill also teaches that an additional exhaust pipe 92 communicates through diaphragm safety valve 94 directly with the space immediately above the chemicals in the chemical reaction chamber 16

In the Applicant's claimed invention, sealed cylinders with rotatable containers are provided with hollow and dome-shaped lids, which are connected to the lids by means of bolts. A perforated mesh is mounted in the meeting area of the lids and the cylinders to provide peripheral casing.

Therefore, Gill does not teach the arrangement of dome-shaped lids as claimed in claim 3.

Claim 15 is rejected as being obvious over Checketts and Gill as Checketts teaches that the reactor piston 92 urges the pellets against the sharp edge 95 to be cut in half and Gill et al teaches that the chemical residue outlet valve 20 threaded to a flushing pipe 18 in communication with a chemical residue discharge tube 24.

Applicant respectfully submits that in view of the foregoing submissions, it is clear that the arrangement of ramming members with disintegration sites and having reciprocal movements to disintegrate the encapsulated metal hydride shells is different and distinct from that hydrogen generation system as shown in Checketts and the complex valve arrangement of Gill as described above. Therefore, Checketts and Gill neither suggest nor teach motivate a person having ordinary skill in the art to arrive at the ramming member arrangement and outlet (27) at the bottom of cylinders.

Claim 20 is rejected as being obvious over Checketts, Dalla Betta, Gill et al. It is asserted in the Office Action on pages 18 and 19 that the method as claimed in claim 20 is obvious, stating that

- (i) mounting the sealed cylindrical housing 52 on a bottom cover 54 filled with water and a container with encapsulated metal hydride pellets,
- (ii) directing the encapsulated metal hydride pellets through feed tube 91 into the reactor piston 92 by letting pellets flow upwardly and crushing the desired quantities of encapsulated metal hydride pellets to disintegrate,
- (iii) dispersing the metal hydride into water,
- (iv) reacting the metal hydride with water to produce hydrogen,
- (v) releasing the hydrogen through outlet 96 at the top of cylinder.

The Office Action further asserts that Checketts does not expressly teach that directing the encapsulated metal hydride into the ramming means is achieved by means of baffles. However, Dalla Betta et al utilizes baffles to direct the desired amount of flow through the rotating fuel processing catalyst and hence it is obvious.

Applicant respectfully submits that the claim 20 is directed to method of production of hydrogen gas by using the system as claimed in claim 1. In view of the foregoing submissions, it stands established that neither Checketts nor Dalla Betta discloses, suggests or motivates the method of production of hydrogen as claimed by the Applicant.

Claim 23 is rejected as obvious over Checketts and Gill.

It is the submission of the Applicant that the principle behind the reaction reacting the metal hydride with water in the presence of aluminum in the range of 5-50%. The subject matter of claim 23 is dependent on the Claim 20. Considering the foregoing submissions that establish the distinguishing features of the system as claimed in claim 1 and further the fact that the subject matter of claim 23 is dependant on Claim 20, which is method implemented by the system as claimed in claim 1, Applicant is of considered view that Checketts and Gill does disclose, suggest, teach or motivate any person having ordinary skill in the art to arrive at the subject matter as claimed in claim 23.

Claims 10 and 19 are rejected under Section 35 U.S.C 103 (a) as being unpatentable over Checketts, in view of Petillo et al., Houser, Dalla Betta et al., Koog as applied to claims 1, 4-9, 11-12, 14, 16-18, 21-22 and 27 above and further in view of US 5,356,274 (Lee).

In addition to the foregoing submissions, the Office Action vide pages 20 & 21 cites Lee, which discloses the use of hydraulic seal and rejects Claims 10 and 19. In this regard, it is submitted that Lee uses a non-return valve to avoid the creation of vacuum in the pipe resulting in non-functioning or priming of the pump. Whereas, in the claimed invention the hydraulic seal is used to prevent the leakage of water and hydrogen from the cylinders through the piston.

It is therefore submitted that the subject matter of claims 10 and 19 are not obvious in the light of cited prior art references.

Claims 24-26 are rejected under Section 35 U.S.C 103 (a) as being unpatentable over Checketts, in view of Petillo et al., Houser, Dalla Betta et al and Koog and further in view of Gill et al., as applied above, further in view of US 6,800,258 of Andersen et al.

Applicant respectfully submits that the reaction of aluminum with NaOH is a well-known reaction. However, in the claimed invention the encapsulated metal hydride shells such as sodium hydride shells react with water to produce in situ NaOH, and heat due to exothermic reaction. NaOH thus produced is further used to generate more hydrogen. This helps us to produce more quantity of hydrogen per unit volume of the system.

For at least the foregoing reasons, Applicant respectfully submits that the claims 24-26 (as amended for improved clarity) are non-obvious and patentable under 35 USC § 103(a) over the alleged combination of the cited references.

In view of the foregoing, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 103(a) rejections.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

23373

CUSTOMER NUMBER

Date: May 14, 2009

/Quadeer A. Ahmed/
Quadeer A. Ahmed
Registration No. 60,835